

## What Is Claimed Is:

- 1            1. A method of providing different quality of services (QOS) to different layer-3  
2            datagrams to be transported from a first network device to a second network device connected  
3            by a backbone, said method comprising:  
4                   provisioning a tunnel in said first network device, said tunnel terminating at said second  
5            network device via said backbone, said tunnel being implemented to provide different QOS to  
6            different packets depending on a packet header for the corresponding packet;  
7                   receiving a layer-3 datagram in said first network device, said layer-3 datagram  
8            containing a datagram header and a datagram data;  
9                   examining said datagram header in said first network device to determine a QOS to be  
10           provided to said layer-3 datagram;  
11                  forming at least one packet in said first network device by encapsulating at least said  
12           datagram data, wherein said at least said datagram data is encapsulated for transporting on said  
13           tunnel, said at least one packet containing a packet header to provide said QOS determined by  
14           said examining; and  
15                  sending said at least one packet to said second network device on said tunnel,  
16           whereby layer-3 datagrams receive different QOS based on the corresponding datagram  
17           headers.
- 1            2. The method of claim 1, wherein said backbone is implemented to transport packets  
2            according to asynchronous transfer mode (ATM) protocol.

1           3. The method of claim 2, wherein said provisioning further comprises implementing  
2       said tunnel using a plurality of virtual circuits (VC) forming a VC bundle, wherein each of said  
3       plurality of virtual circuits provides one of said different QOS provided by said tunnel.

1           4. The method of claim 2, wherein said at least one packet comprises a plurality of  
2       packets, wherein each of said plurality of packets is formed according to said ATM protocol.

1           5. The method of claim 1, wherein said tunnel is implemented using UDP/IP packets,  
2       wherein each UDP/IP packet contains a TOS/Precedence field, said TOS/Precedence field  
3       determining the QOS provided to the corresponding UDP/IP packet, said at least one packet  
4       comprising a UDP/IP packet, said forming comprising determining the value of said  
5       TOS/Precedence field according to said datagram header of said layer-3 datagram.

1           6. The method of claim 5, wherein said layer-3 datagram comprises an IP datagram, and  
2       wherein said forming comprises copying the TOS/precedence bits in said IP datagram to said  
3       TOS/precedence field of a UDP/IP packet encapsulating said IP datagram.

1           7. The method of claim 1, wherein said receiving comprises receiving said layer-3  
2       datagram on a point-to-point session, said method further comprising indicating in said first  
3       network device whether to provide different QOS to different datagrams received on said point-  
4       to-point session, wherein said first network device provides different QOS to datagrams received  
5       on said point-to-point session based on said indicating.

1           8. The method of claim 7, further comprising indicating in a table a default QOS to be  
2 used with said point-to-point session, wherein said determining comprises associating said  
3 default QOS to said layer-3 datagram if said datagram header does not provide an indication of  
4 the QOS to be provided to said layer-3 datagram.

1           9. The method of claim 1, wherein said first network device comprises either a network  
2 access server (NAS) or a home gateway.

1           10. A first network device providing different quality of services (QOS) to different  
2 layer-3 datagrams to be transported to a second network device connected by a backbone, said  
3 first network device comprising:

4           means for provisioning a tunnel terminating at said second network device via said  
5 backbone, said tunnel being implemented to provide different QOS to different packets  
6 depending on a packet header for the corresponding packet;

7           means for receiving a layer-3 datagram, said layer-3 datagram containing a datagram  
8 header and a datagram data;

9           means for examining said datagram header to determine a QOS to be provided to said  
10 layer-3 datagram;

11           means for forming at least one packet by encapsulating at least said datagram data,  
12 wherein said at least said datagram data is encapsulated for transporting on said tunnel, said at  
13 least one packet containing a packet header to provide said QOS determined by said examining;

14 and  
15 means for sending said at least one packet to said second network device on said tunnel,  
16 whereby layer-3 datagrams receive different QOS based on the corresponding datagram  
17 headers.

1 11. The first network device of claim 10, wherein said backbone is implemented to  
2 transport packets according to asynchronous transfer mode (ATM) protocol, wherein said means  
3 for provisioning implements said tunnel using a plurality of virtual circuits (VC) forming a VC  
4 bundle, wherein each of said plurality of virtual circuits provides one of said different QOS  
5 provided by said tunnel, wherein said at least one packet comprises a plurality of packets,  
6 wherein each of said plurality of packets is formed according to said ATM protocol.

1 12. The first network device of claim 10, wherein said tunnel is implemented using  
2 UDP/IP packets, wherein each UDP/IP packet contains a TOS/Precedence field, said  
3 TOS/Precedence field determining the QOS provided to the corresponding UDP/IP packet, said  
4 at least one packet comprising a UDP/IP packet, said means for forming determining the value  
5 of said TOS/Precedence field according to said datagram header of said layer-3 datagram.

1 13. The first network device of claim 12, wherein said layer-3 datagram comprises an  
2 IP datagram, and wherein said means for forming copies the TOS/precedence bits in said IP  
3 datagram to said TOS/precedence field of a UDP/IP packet encapsulating said IP datagram.

1 14. The first network device of claim 10, wherein said means for receiving receives said  
2 layer-3 datagram on a point-to-point session, said first network device further comprising means  
3 for indicating to indicate whether to provide different QOS to different datagrams received on  
4 said point-to-point session, wherein said first network device provides different QOS to  
5 datagrams received on said point-to-point session based on said indicating.

1 15. The first network device of claim 14, further comprising indicating in a table a  
2 default QOS to be used with said point-to-point session, wherein said means for determining  
3 associates said default QOS to said layer-3 datagram if said datagram header does not provide  
4 an indication of the QOS to be provided to said layer-3 datagram.

1 16. The first network device of claim 10, wherein said first network device comprises  
2 either a network access server (NAS) or a home gateway.

1 17. A first network device providing different quality of services (QOS) to different layer-  
2 3 datagrams to be transported to a second network device connected by a backbone, said first  
3 network device comprising:

4 an input interface receiving a layer-3 datagram, said layer-3 datagram containing a  
5 datagram header and a datagram data;

6 a marker determining a QOS to be provided to said layer-3 datagram;

7 a tunnel encapsulator encapsulating at least said datagram data to generate encapsulated  
8 data, said encapsulated data being encoded for transporting on a tunnel set up via a backbone to

9 a second network device, said tunnel providing different QOS to packets having different packet  
10 headers;

11 a forwarding block forming at least one packet to transport said at least said datagram  
12 data, wherein said at least said datagram data is encapsulated for transporting on said tunnel, said  
13 at least one packet containing a packet header to provide said QOS determined by said  
14 examining; and

15 an output interface sending said at least one packet to said second network device on said  
16 tunnel,

17 whereby layer-3 datagrams receive different QOS based on the corresponding datagram  
18 headers.

1 18. The first network device of claim 17, wherein said marker examines said datagram  
2 header to determine said QOS.

1 19. The first network device of claim 18, wherein said layer-3 datagram is received on  
2 a point-to-point session.

1 20. The first network device of claim 19, further comprising:

2 a memory indicating whether to provide different QOS to different layer-3 datagrams  
3 related to said point-to-point session; and

4 a classifier determining whether said layer-3 datagram relates to said point-to-point  
5 session, wherein said marker provides different QOS to different layer-3 datagrams only if said

6 memory indicates that different QOS to different layer-3 datagrams relates to said point-to-point  
7 session,  
8 whereby said first network device provides different QOS to different layer-3 datagrams  
9 received only on some point-to-point sessions.

1 21. The first network device of claim 20, wherein said packet comprises an ATM cell  
2 and said tunnel is implemented using a virtual circuit (VC) bundle containing a plurality of  
3 virtual circuits, wherein each of said plurality of virtual circuits is provisioned to provide one of  
4 said different QOS provided by said tunnel.

1 22. The first network device of claim 20, wherein said packet comprises a UDP/IP packet  
2 containing a type of service (TOS)/precedence field, wherein said layer-3 datagram comprises  
3 an Internet protocol (IP) datagram also containing a TOS/precedence field, said marker  
4 providing at least some of the bits of said TOS/precedence field of said IP datagram for copying  
5 into said TOS/precedence field of said UDP/IP packet.

1 23. The first network device of claim 20, wherein said memory further indicates a default  
2 QOS to be provided to datagrams received on said point-to-point connection, wherein said  
3 marker accesses said memory to provide said default QOS to said layer-3 datagram if QOS  
4 cannot be determined by examining said packet header.

1 24. A computer readable medium carrying one or more sequences of instructions for

2 causing a first network device to provide different quality of services (QOS) to different layer-3  
3 datagrams when sending to a second network device on a backbone, said first network device,  
4 second network device and said backbone being contained in a communication network, wherein  
5 execution of said one or more sequences of instructions by one or more processors contained in  
6 said network device causes said one or more processors to perform the actions of:  
7 provisioning a tunnel in said first network device, said tunnel terminating at said second  
8 network device via said backbone, said tunnel being implemented to provide different QOS to  
9 different packets depending on a packet header for the corresponding packet;  
10 receiving a layer-3 datagram in said first network device, said layer-3 datagram  
11 containing a datagram header and a datagram data;  
12 examining said datagram header in said first network device to determine a QOS to be  
13 provided to said layer-3 datagram;  
14 forming at least one packet in said first network device by encapsulating at least said  
15 datagram data, wherein said at least said datagram data is encapsulated for transporting on said  
16 tunnel, said at least one packet containing a packet header to provide said QOS determined by  
17 said examining; and  
18 sending said at least one packet to said second network device on said tunnel,  
19 whereby layer-3 datagrams receive different QOS based on the corresponding datagram  
20 headers.

1 25. The computer readable medium of claim 24, wherein said backbone is implemented  
2 to transport packets according to asynchronous transfer mode (ATM) protocol.



1           26. The computer readable medium of claim 25, wherein said provisioning further  
2 comprises implementing said tunnel using a plurality of virtual circuits (VC) forming a VC  
3 bundle, wherein each of said plurality of virtual circuits provides one of said different QOS  
4 provided by said tunnel.

1           27. The computer readable medium of claim 25, wherein said at least one packet  
2 comprises a plurality of packets, wherein each of said plurality of packets is formed according  
3 to said ATM protocol.

1           28. The computer readable medium of claim 24, wherein said tunnel is implemented  
2 using UDP/IP packets, wherein each UDP/IP packet contains a TOS/Precedence field, said  
3 TOS/Precedence field determining the QOS provided to the corresponding UDP/IP packet, said  
4 at least one packet comprising a UDP/IP packet, said forming comprising determining the value  
5 of said TOS/Precedence field according to said datagram header of said layer-3 datagram.

1           29. The computer readable medium of claim 28, wherein said layer-3 datagram  
2 comprises an IP datagram, and wherein said forming comprises copying the TOS/precedence bits  
3 in said IP datagram to said TOS/precedence field of a UDP/IP packet encapsulating said IP  
4 datagram.

1           30. The computer readable medium of claim 24, wherein said receiving comprises

2 receiving said layer-3 datagram on a point-to-point session, said method further comprising  
3 indicating in said first network device whether to provide different QOS to different datagrams  
4 received on said point-to-point session, wherein said first network device provides different QOS  
5 to datagrams received on said point-to-point session based on said indicating.

1 31. The computer readable medium of claim 30, further comprising indicating in a table  
2 a default QOS to be used with said point-to-point session, wherein said determining comprises  
3 associating said default QOS to said layer-3 datagram if said datagram header does not provide  
4 an indication of the QOS to be provided to said layer-3 datagram.

1 32. The computer readable medium of claim 24, wherein said first network device  
2 comprises either a network access server (NAS) or a home gateway.